

Serial No. 09/689,817
WAK.066

7

REMARKS

Claims 1-10 and 17-33 are all the claims presently being examined in the application. Applicant gratefully acknowledges the Examiner's allowance of claims 2-4, 6, 7, 9, 10, 18, 19 and 25.

With respect to the prior art rejections, claims 1, 17, 20, 21, 24, 27-29, 32, and 33 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393). Claims 8 and 26 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393) and as evidenced by Poehler, et al. (U.S. Pat. No. 5,637,421). Claims 5 and 22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393).

Further, claim 23 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393) and further in view of Koksbang, et al. (U.S. Pat. No. 5,424,151). Claim 30 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393) and further in view of Koksbang, et al. (U.S. Pat. No. 5,424,151). Claim 31 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Hoshi, et al. (U.S. Pat. No. 6,299,653 B1) in view of Larkin (U.S. Pat. No. 6,306,215 B1) and Boer, et al. (U.S. Pat. No. 5,656,393) and further in view of Tasaka, et al. (U.S. Pat. No. 6,280,854 B1).

Serial No. 09/689,817
WAK.066

8

These rejections are respectfully traversed in view of the following discussion.

Entry of this 1.116 Amendment is proper. Since the amendments above narrow the issues for appeal and since such features were in the claims earlier, such amendments do not raise a new issue requiring further searching and/or consideration by the Examiner. As such entry of this Amendment is believed to be proper and is earnestly solicited.

It is noted that the amendments are made only to more particularly define the invention and not for distinguishing the invention over the prior art, for narrowing the scope of the claims, or for any reason related to a statutory requirement for patentability.

It is further noted that, notwithstanding any claim amendments made herein, Applicant's intent is to encompass equivalents of all claim elements, even if amended herein or later during prosecution.

I. THE CLAIMED INVENTION

Applicant's invention, as disclosed and claimed, for example by claim 1, is directed to a molded electrode.

The molded electrode includes an electrode material comprising a polymer active material, a conductivity-enhancing agent and a plasticizer, and a current collector sheet. The electrode material and the current collector sheet is molded into one piece, and the electrode material having a thickness of 300 μm to 9 mm and formed on at least one side of the current collector sheet. Importantly, the plasticizer includes a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation. (See Page 7, lines 10-17; Page 16, line 25-Page 17, line 18; Page 18, line 20-Page 19, line 8; and Page 20, lines 24-26).

Serial No. 09/689,817
WAK.066

9

A conventional battery includes an electrode material with a coating film having a thickness of 20 μm to 100 μm on a current collector with an evaporative solvent. However, in the conventional art device, the coating film tends to crack during drying, and "this phenomenon is more striking when the coating film is formed in a larger thickness." Thus, it is difficult to form a thick film and increase the active material, which results in a structure with increased electrical resistance and decreased power density. (See Page 1, lines 12-21; Page 2, lines 2-26).

On the other hand, the inventive structure includes a plasticizer which includes a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation. Specifically, the plasticizer maybe used to plasticize the polymer active material to facilitate the mold of electrode from a mixed powder during the molding and to keep its shape after molding. The resultant structure has a "relatively high density packing, and has such a relatively high hardness as regarded as a so-called molded plastic" and permits "the electrode to [can] function as such, ..., and yet has, by itself shape retainability similar to plastic molded materials obtained by molding." Since the present molded electrode has shape retainability by itself, the electrode material can have a large thickness. Therefore, an electrode structure is formed with a large ratio of the volume of the electrode active material to the volume of the current collector as well as a high adhesivity between the current collector and the electrode material with a very low interfacial resistance. (See Page 4, line 18-Page 5, line 3; Page 7, lines 10-17; Page 18, line 2-Page 19, line 8).

As a result, the inventive molded electrode has a small internal impedance of the electrode permitting high energy density and high power density, and thus a high degree of

Serial No. 09/689,817
WAK.066

10

freedom is available in designing the battery. (See Page 3, line 19-Page 4, line 1; Page 7, line 26-Page 8, line 10; and Page 9, lines 17-23).

II. 35 U.S.C. § 112, First Paragraph, Rejections

In response to the assertion of indefiniteness, Applicant has amended claim 26 to include, "a surface area larger than a surface area of said electrode material with a flat surface." This amendment clarifies and specifically defines the limitation presented in this claim consistent with the Specification. (See Specification, Page 18-22; and Figure 4).

Second, Applicant traverses the rejection regarding claim 27 as it is well known in the art and clear on its face what these various classes of chemicals reference. Further, it is a commonly accepted practice to include terms such as "aniline derivative" in chemical patent Claim 9. In addition, the Specification clearly and further defines specific derivative compounds in each chemical class listed in claim 27. (See Specification, Page 15, line 1-Page 16, line 10).

In view of the foregoing, the Examiner is requested to withdraw these rejections.

III. THE PRIOR ART REJECTIONS

A. The 103(a) Rejection of Claims 1, 5, 17, 20, 21, 22, 24, 27-29, 32 and 33

First, the references, separately, or in combination, fail to teach, disclose or provide a reason or motivation for being combined. In particular, Hoshi, et al. pertains to a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid. Thus, Hoshi is specifically directed to solving the problems experienced by

Serial No. 09/689,817
WAK.066

11

conventional batteries which are rendered ineffective by significantly reduced: 1) ionic conductivity; 2) high temperature stability; and 3) adherability to an electrode. (See Hoshi at Abstract; Column 1, lines 5-30; Column 4, lines 35-56).

By contrast, Larkin does not have the same aim as Hoshi. Instead, Larkin discloses an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material for electrochemical cells. The coating apparatus includes a source of current collector material, a reservoir containing a liquid composition, a first rotatable roller and a second rotatable roller. (See Larkin at Abstract; Column 1, lines 5-10; and Column 3, lines 50-60).

Nothing within Larkin suggests an a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid as disclosed in Hoshi. Accordingly, Larkin does not attempt to increase: 1) ionic conductivity; 2) high temperature stability; and 3) adherability to an electrode by using a hybrid electrolyte. Thus, Hoshi is a stand alone invention which teaches away from being combined with, for example, Larkin.

Further, Boer, et al. does not have the same aim as either Hoshi or Larkin. Instead, Boer discloses a flexible polymer bonded electrode composite including a polymer matrix with an electrochemically active particulate material and a microporous conductive sheet encapsulated within the polymer matrix where a continuous process of forming the electrode by extrusion is possible using a cross-head die. (See Boer at Abstract; Column 1, lines 5-11; and Column 3, lines 20-30).

Boer, therefore, is concerned with forming an easily fabricated polymer bonded electrode with a high content of electrochemically active particulate material exhibiting a high

Serial No. 09/689,817
WAK.066

12

degree of uniformity of distribution across the sheet where the material is highly flexible for easy formation into the desired configuration and maintains the condition of the battery during expansion and contraction of cycling. (See Column 2, line 66-Column 3, line 20).

Nothing within Boer suggest a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid as disclosed in Hoshi. Boer also does not suggest an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material for electrochemical cells as in Larkin. Thus, Hoshi is a stand alone invention which teaches away from being combined with another invention for example Larkin or Boer.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight. It is clear that the Examiner has simply read Applicant's specification and conducted a keyword search to yield Hoshi, Larkin and Boer. However, the shape and resultant function of the hybrid electrolyte in Hoshi is completely different than the apparatus of Larkin or the flexible polymer bonded electrode of Boer, let alone the present invention. Further, the Examiner provides no motivation or reason to combine other than to assert that it would have been obvious to one having ordinary skill in the art at the time to add a plasticizer from Larkin and a thickness of the active material layer from Boer to Hoshi. (See Office Action at Page 5). Such an assertion does not take into account the distinct structural differences of the inventions as indicated above, and further discussed below. Thus, the Examiner's conclusion attempts to solve a problem which does not exist with Hoshi.

Second, even if combined, the references do not teach or suggest the features of independent claim 1, which recites "wherein the plasticizer comprises a material for

Serial No. 09/689,817
WAK.066

13

facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation." (See Page 7, lines 10-17; Page 16, line 25-Page 17, line 18; Page 18, line 20-Page 19, line 8; and Page 20, lines 24-26).

Applicant agrees with the assertion in the Office Action that Hoshi does not disclose, teach or suggest at least two features of the claimed invention, including, "the molded [positive] electrode contains a plasticizer in the [positive] electrode material" and "the thickness of the [positive] electrode material is 300 microns to 9 mm." (See Office Action at Page 4, Paragraph 4). Accordingly, Hoshi does not teach or suggest, "wherein the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation", as recited in claim 1.

Second, Larkin does not make up for the deficiencies of Hoshi. Instead, Larkin discloses an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material. Larkin is not relevant to the present invention. Larkin discloses using a plasticizer to form a porous solid polymer matrix and a composite electrode that includes polymeric binders. In fact, Larkin describes the term "plasticizer" to refer to an organic solvent, with limited solubility of polymers, that facilitates the formation of the porous polymeric structure (See Larkin, Column 6, lines 29-30).

However, this is not the general use of the term "plasticizer". In the present invention, the plasticizer is used to plasticize the polymer active material to facilitate the mold of electrode from a mixed powder during the molding and to keep its shape after molding (See Page 7, lines 10-17). In this sense, Larkin never discloses the use of "plasticizer" in the same manner that "plasticizer" works in the commonly-used meaning, not to mention to plasticize

Serial No. 09/689,817
WAK.066

14

the polymer active material. Thus, Larkin does not disclose, teach or suggest, wherein the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation.

In addition, the current collector is coated with a layer of an electrically conductive adhesive material where the adhesive material comprises a solvent, an adhesion polymer and an electrically conductive material. (See Column 3, lines 60-65; Column 4, lines 37-41; Column 5, lines 38). “Once the surface is coated, the solvent is removed by evaporation, for instance, to leave the adhesion promotion layer attached to the surface of the current collector.” It is noted that the “plasticizer refers to an organic solvent” where “the plasticizer is removed by extraction” (See Column 6, lines 28-50) similar to the plasticizers used in conventional batteries, as discussed above, which inhibits the formation of thick films thus decreasing the energy density of the battery. (See Page 3, lines 4-13). Thus, Larkin discloses an electrically conductive adhesive material, not an electrode material comprising a polymer active material, a conductivity-enhancing agent and a plasticizer, let alone, where the electrode material and the current collector sheet are molded into one piece as disclosed in Applicant’s invention.

Based on the above, Applicant traverses the applicability of the assertion in the Office Action that “Larkin teaches using dibutyl phthalate as a plasticizer in the electrode compositions to facilitate the formation of the porous structure in the electrode which is extracted after the electrode is formed to form a porous electrode structure.”(See Office Action at Page 5, First Paragraph).

Thus, Larkin does not resolve any of the deficiencies of Hoshi.

Third, Boer, et al. does not make up for the deficiencies of either Hoshi or Larkin.

Serial No. 09/689,817
WAK.066

15

Instead, Boer discloses a flexible polymer bonded electrode composite. (See Column 2, line 66-Column 3, line 20). "The subject electrode composite comprises a microporous sheet composed of a substantially uniform mixture of a polymer and electrochemically active and electrically conductive materials which has a porous conductive sheet encapsulated therein." (See Column 3, lines 20-30, 40-47 and 60-65; Column 4, lines 1-5, 17-27 and 50-57). As indicated, the current collector is encapsulated within the electrode whereas Applicant's invention discloses the electrode material and the current collector sheet are molded into one piece and "formed on at least one side of the current collector sheet." Since the electrode and the current collector are encapsulated, it is difficult for Boer to separate the physical characteristics of the electrode and the current collector. However, Boer does not disclose the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation as taught by Applicant's invention.

For emphasis, Applicant traverses the assertion in the Office Action that "[t]he electrode material having this amount of plasticizer would inherently have a porosity of 20-30% by volume since the polymer active materials in Hoshi and the range of plasticizer in electrode material of Larkin are the same as those claimed and disclosed by applicants." (See Office Action, Page 7, 5th paragraph - Page 8, 1st Paragraph).

Finally, Applicant indicates that Boer, similarly to the conventional art, may attempt to form an active material layer with a binder or a plasticizer but the result is cracking of the coating film, particularly, when trying to form a thick film. Thus it is difficult to increase the active material, which tends to increase electrical resistance and decrease power density. (See Page 1, lines 12-18; Page 2, lines 2-26; and Page 3, lines 4-13).

Serial No. 09/689,817
WAK.066

16

For at least the reasons outlined above, Applicant respectfully submits that none of Hoshi, Larkin and Boer teach or suggest all of the features of the independent claim 1 and dependent claims 5, 17, 20, 21, 24, 27-29, 32 and 33.

Regarding the dependent claims 5, 17, 20, 21, 24, 27-29, 32 and 33, which depend respectively from claim 1, these claims are patentable not only by virtue of their dependency from their respective independent claims, but also by the additional limitations they recite.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 1, should be fully patentable over the cited references.

B. The Poehler, et al. Reference

First, as a result of the Examiner's keyword search, Applicant notes that no less than four references have been "kluged" together using impermissible hindsight to yield Applicant's invention. This suggestion on its face clearly strains the reasonableness of what "would have been obvious" at the time of Applicant's invention.

Indeed, Poehler, et al. ("Poehler") does not have the same aim as Hoshi, Larkin or Boer and the combination would not have been made absent hindsight.

Poehler is non-analogous art and is directed to "problems associated with the utilization of conducting polymers in charge storage devices includ[ing] retention of processability at high conductivity levels and environmental stability" by "processing conjugated polymeric electrodes and incorporating them with a gel polymer electrolyte to form an entirely polymeric quasi-solid state charge storage device, that is lightweight, stable, exhibits high reversibility, and maintains high room temperature conductivity." (See Column 1, lines 30-38; and Column 4, lines 5-12).

Serial No. 09/689,817
WAK.066

17

Nothing within Poehler suggests a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid as disclosed in Hoshi. Poehler also does not suggest an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material for electrochemical cells as disclosed in Larkin. Poehler further does not suggest a flexible polymer bonded electrode composite with a high content of electrochemically active particulate material, which exhibits a high degree of uniformity of distribution across the sheet where the material is highly flexible for easy formation into the desired configuration as disclosed in Boer.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight.

Second, even if combined, Poehler does not make up for the deficiencies of Hoshi, Larkin and Boer as indicated above. That is, the references do not teach or suggest the features of independent claim 1, including the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation. (See Page 7, lines 10-17; Page 16, line 25-Page 17, line 18; Page 18, line 20-Page 19, line 8; and Page 20, lines 24-26).

For the reasons stated above, the claimed invention, is fully patentable over the cited references.

C. The Koksbang, et al. Reference

To make up for the deficiencies of Hoshi, Larkin, and Boer, the Examiner relies on Koksbang, et al. ("Koksbang"). Koksbang fails to do so.

First, Koksbang does not have the same aim as Hoshi, Larkin or Boer as discussed

Serial No. 09/689,817
WAK.066

18

above, and the urged combination would not have been made, absent hindsight.

Koksbang discloses a cathode composition, and related method with a first and second polymeric materials where the first material is cured by radiation and the second polymeric material is electrochemically cured. (See Koksbang at Abstract).

Koksbang is specifically directed to solving the drawbacks of increased cell impedance due to the "failure of the cathode material to make good contact with the cathode current collector and with the solid electrolyte layer." Indeed, Koksbang attempts to reduce impedance by enhancing "contact between the positive electrode material and the respective materials of the current collector and the electrolyte layer at the interfaces." (See Column 1, lines 5-15 and 42-60; and Column 4, lines 48-60).

Nothing within Koksbang, which focuses on radiation curing of a first polymeric material and electrochemically curing a second polymeric material, has anything to do with a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid as disclosed in Hoshi. Koksbang also does not suggest an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material for electrochemical cells as disclosed in Larkin. Koksbang further does not suggest a flexible polymer bonded electrode composite with a high content of electrochemically active particulate material, which exhibits a high degree of uniformity of distribution across the sheet where the material is highly flexible for easy formation into the desired configuration as disclosed in Boer. Thus, Hoshi, Larkin and Boer teach away from being combined with each other as well another invention, such as, Koksbang.

Therefore, one of ordinary skill in the art would not have combined these references.

Serial No. 09/689,817
WAK.066

19

absent hindsight.

Secondly, Koksbang does not disclose, teach or suggest, including the electrode material includes a porosity of 20-30 % in volume as recited in claim 1. (See Page 8, line 25-Page 9, line 16; Page 22, lines 15-19).

Further, Koksbang does not disclose, teach or suggest, including the current collector sheet comprises a thickness of no more than about 100 μ m as recited in claim 23.

Instead, Koksbang recites a cathode composition, and related method, with a first and second polymeric materials where the first material is cured by radiation and the second polymeric material is electrochemically cured. (See Koksbang at Abstract). Since Koksbang does not disclose, teach or suggest either an electrode material comprising a polymer active material, a conductivity-enhancing agent and a plasticizer or the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation, Koksbang is deficient and thus does not teach the specific limitations of dependent claims 23 and 30.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 1, and related dependent claims 23 and 30, should be fully patentable over the cited references.

D. The Tasaka, et al. Reference

To make up for the deficiencies of Hoshi, Larkin, and Boer, the Examiner relies on Tasaka, et al. ("Tasaka"). Tasaka fails to do so.

First, Tasaka does not have the same aim as Hoshi, Larkin or Boer as discussed above, and the urged combination would not have been made, absent hindsight.

Tasaka discloses a polymer electrode with an "electrode composite material containing

Serial No. 09/689,817
WAK.066

20

an active material containing at least three components of polyaniline, polypyrrole and a quinone compound, a conducting agent and a binder and a collecting body to carry the slurry of electrode composite material. (See Tasaka at Abstract; and Column 11, lines 37-55).

Tasaka is specifically directed to solving the drawbacks of forming a secondary battery with a uniform large electrode area with a large battery capacitance from light-weight conducting polymers. Indeed, Tasaka attempts "to provide a polymer electrode having a high energy density, which is required in a secondary battery having a large battery capacitance." (See Column 1, lines 5-30; Column 1, line 60-Column 2, line 20).

Nothing within Tasaka, which focuses on an "electrode composite material containing an active material containing at least three components of polyaniline, polypyrrole and a quinone compound, a conducting agent and a binder," has anything to do with a hybrid electrolyte including a shaped porous polymer structure with a polymer matrix and a plurality of cells where the shaped polymer structure is impregnated and swelled with an electrolytic liquid as disclosed in Hoshi. Tasaka also does not suggest an apparatus for continuously coating a web of current collectors with an electrically conductive adhesive material for electrochemical cells as disclosed in Larkin. Tasaka further does not suggest a flexible polymer bonded electrode composite with a high content of electrochemically active particulate material, which exhibits a high degree of uniformity of distribution across the sheet where the material is highly flexible for easy formation into the desired configuration as disclosed in Boer. Thus, Hoshi, Larkin and Boer teach away from being combined with each other as well another invention, such as, Tasaka.

Therefore, one of ordinary skill in the art would not have combined these references, absent hindsight.

Serial No. 09/689,817
WAK.066

21

Secondly, Tasaka does not disclose, teach or suggest including the electrode material includes a porosity of 20-30 % in volume as recited in claim 1. (See Page 8, line 25-Page 9, line 16; Page 22, lines 15-19).

Further, Tasaka does not disclose, teach or suggest, including a weight ratio is in the range 50:50 to 90:10 of the polymer active material to the conductivity-enhancing agent as recited in claim 31.

Instead, Tasaka recites a polymer electrode with an "electrode composite material containing an active material containing at least three components of polyaniline, polypyrrole and a quinone compound, a conducting agent and a binder." A collecting body is used to carry the slurry of the electrode composite material. (See Tasaka at Abstract; and Column 11, lines 37-55). The electrode composite material includes a binder like the conventional art as indicated above, but does not disclose, teach or suggest either an electrode material comprising a polymer active material, a conductivity-enhancing agent and a plasticizer without a binder, or the plasticizer comprises a material for facilitating the molding of the electrode and enhancing the shape retainability after molding, and is present when the electrode is in operation, as in Applicant's invention. Accordingly, Tasaka is deficient and thus does not teach the specific limitations of dependent claim 31.

For the reasons stated above, the claimed invention, and the invention as cited in independent claim 1, and related dependent claim 31, should be fully patentable over the cited references.

Serial No. 09/689,817
WAK.066

22

IV. FORMAL MATTERS AND CONCLUSION

In view of the foregoing, Applicant submits that claims 1-10 and 17-33, all the claims presently pending in the application, are patentably distinct over the prior art of record and are in condition for allowance. The Examiner is respectfully requested to pass the above application to issue at the earliest possible time.

Should the Examiner find the application to be other than in condition for allowance, the Examiner is requested to contact the undersigned at the local telephone number listed below to discuss any other changes deemed necessary in a telephonic or personal interview.

Serial No. 09/689,817
WAK.066

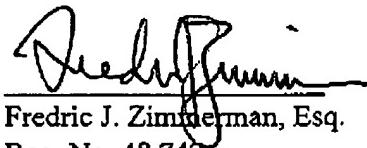
23

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The Commissioner is hereby authorized to charge any deficiency in fees or to credit any overpayment in fees to Attorney's Deposit Account No. 50-0481.

Respectfully Submitted,

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CERTIFICATION OF FACSIMILE TRANSMISSION

I hereby certify that I am filing this Amendment by facsimile with the United States Patent and Trademark Office to Examiner Susy N. Tsang Foster, Group Art Unit 1745 at fax number (703) 872-9311 this 25th day of June, 2003.


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